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ABSTRACT

While the seventh and ninth grade Maryland Functional Mathematics Tests (MFMT) appear valid and well constructed, the 65 percent passing rate for Montgomery County Public Schools' ninth grade students raises questions about the 81 percent passing score set for the MFMT. This standard is far stiffer than the 59 percent set for the Maryland Functional Reading Test (MFRT), passed by 96 percent of Montgomery County ninth graders. Additional comparisons to the California Achievement Test (CAT) results support this apparent difference in standards. Reversing cutting scores would create an apparent "reading crisis" and passing mathematics rates would be 90 percent. Passing rates for special education students was low, ranging from 3 to 32 percent for the five different levels. Marked differences in the ninth grade test passing grades of racial and ethnic groups, and disparities with CAT results, may indicate bias in the MFMT. The passing percentages were: Blacks: 34, Hispanic: 42, Whites: 70, and Asians: 77. Analysis of passing rates by school and by math class indicate that with the present cut score, the problem is countywide and largely confined to students taking Math 9A and Algebra I, Part 1A. Nine charts and tables accompany the discussion. (BS)

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MONTGOMERY COUNTY PUBLIC SCHOOLS
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ANALYSIS OF 1982-83
MARYLAND FUNCTIONAL MATHEMATICS TEST (MFMT) RESULTS

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TM 840 529

June 1983

Edward Andrews
Superintendent of Schools

MONTGOMERY COUNTY PUBLIC SCHOOLS
Rockville, Maryland

ANALYSIS OF 1982-83
MARYLAND FUNCTIONAL MATHEMATICS TEST (MFMT) RESULTS

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ANALYSIS OF 1982-83 MARYLAND FUNCTIONAL MATHEMATICS TEST RESULTS

Overall Results

In order to pass the ninth-grade version of the MFMT, students had to achieve a scale score of 340 points. To obtain a score of 340, they had to answer at least 63 of the 78 multiple-choice questions correctly, which means that the passing score was 81 percent. As shown in Exhibit 1, 65 percent of the 7528 MCPS ninth graders who took the test scored at or above this level. In other school systems, passing rates ranged from as low as 19 percent to as high as 57 percent, with the state average passing rate being 40 percent.

The Maryland State Department of Education did not specify a passing score for the seventh-grade version of the MFMT, since they view it as a diagnostic tool. However, analysis by our own staff indicates that any seventh grader who earned a scale score on the test of 321 should have little difficulty in scoring at least 340 when he/she takes the ninth-grade version two years hence. To achieve a score of 321, seventh graders had to get 63 of 78 multiple-choice questions correct, which means that the unofficial passing score for the seventh grade MFMT was also 81 percent. As shown in Exhibit 2, this level was achieved by 53 percent of the 7502 seventh graders who took the test.

An examination of the test and results indicates that 1) the results are probably not due to problems in the test, and 2) that many students will need fairly intensive work if they are to pass the MFMT.

Examination of the test itself, and the overall scoring patterns, showed that the test items appear to meet standard item writing criteria, and for the most part, have no readily apparent flaws.

What was also learned was that the mode (the score achieved by the most students) for the ninth graders was at 97 percent, with the scores falling off at a slow but even rate from the failing point, 80 percent, down to about 40 percent (see Figure 1); and that the items missed by our students spanned a large number of objectives and were not confined to only a few instructional areas.

Examination of Exhibits 1 and 2 will show that the percentage of students achieving the 81 percent standard was very similar for males and females. The difference for these groups was 1 percent in Grade 9 and 4 percent in Grade 7. In both cases, females outscored the males. These exhibits also show that there are considerable differences in the percentages achieving this standard for students of different races. This matter will be discussed in detail below.

Comparison of MFMT Results With Those of the Maryland Functional Reading Test and the California Achievement Tests

Whereas the passing rate for this year's ninth graders was only 65 percent on the Maryland Functional Mathematics Test, it was 96 percent on the Maryland Functional Reading Test. Does this mean that these students are so much

Exhibit 1

Maryland Functional Math Test, Fall 1982
Percentage of Grade 9 Students Passing
With Score of 81 Percent or Better

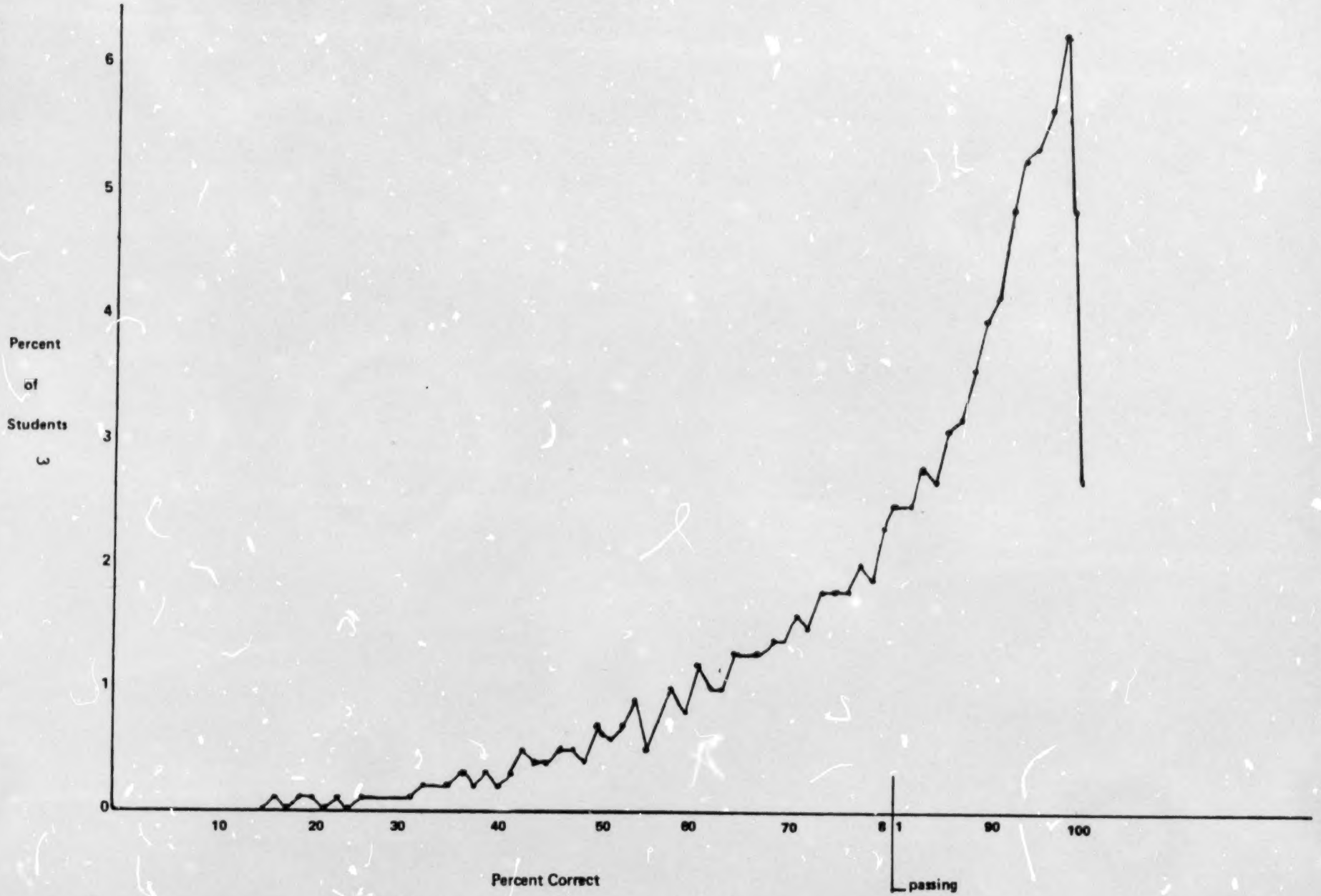
	Items Needed to Pass	Asian	Black	Hispanic	White	Males	Females	Total
Number Tested		475	904	349	5783	3597	3931	7528
Total Score	63 out of 78	77	34	42	70	64	65	65

Exhibit 2

Maryland Functional Math Test, Fall 1982
Percentage of Grade 7 Students Achieving
At Least 81 Percent on the Seventh Grade Test

	Items Needed to Qualify	Asian	Black	Hispanic	White	Males	Females	Total
Number Tested		503	988	285	5712	3828	3674	7502
Total Score	63 out of 78	65	23	38	57	53	54	53

Percent of MCPS Students Achieving Each Score on the MFMT
Grade 9, 1982



better in reading than in mathematics? We don't think so. Rather, we suspect that the disparity in results is more a function of the cut scores (the points below which students fail) on the two tests than the abilities of the students themselves. In addition, two other factors probably also had an impact. These are: 1) the fact that this was the first time the MFMT was administered and 2) the awareness on the part of ninth graders that this test did not really count, that is, they did not have to pass the test to graduate.

To achieve a passing score (a scale score of 340) on the Maryland Functional Reading Test, the State Department of Education determined that students had to answer only 59 percent of the questions correctly, whereas on the MFMT, it was decided that they had to answer 81 percent correctly. With this huge difference in cut scores, it is not surprising that the passing rates are so different.

As shown in Exhibit 3, if the passing rate on the MFRT had been set at 81 percent, as was the case with the math test, then only 71 percent of these ninth graders would have passed the reading test. Similarly, had the passing rate on the MFMT been set at 59, as was the case with the reading test, then 90 percent of these student would have passed the math test.

Viewed in tandem, these results suggest that the current "crisis in mathematics" that has emerged as a result of statewide performance on this test is, at least in part, a function of the passing standard used. Comparisons with data on the Maryland Functional Reading Test show that the standards on the two functional tests differ greatly, with the mathematics test using a far stiffer standard. If the standard for mathematics were adopted in reading, a "reading crisis" would be declared; and if the reading standard were applied to mathematics, passing rates would be at the level to which Montgomery County is accustomed.

Exhibit 3

Percentage of 9th Grade Students Who Would Pass the MFRT and MFMT at Various Cut-Scores

Percent Correct	Percentage of Students Who Would Pass at Various Cut-Scores	
	MFRT	MFMT
90	66	44
81 (Passing on MFMT)	71	65
70	89	80
59 (Passing on MFRT)	96	90
50	98	95
40	99	98

Exhibit 4 shows the relationship between MFMT scores and those achieved by the same students on the Maryland Functional Reading Test and the California Achievement Tests. The most striking finding of this exhibit is that to have at least a 90 percent chance of passing the MFMT, a student must score in at least the seventh stanine on the math portion of the California Achievement Tests. This is rather unusual for a "functional" test, since to achieve in the seventh stanine on the California Achievement Test, a student has to better the performance of 78 percent of the students who were in the original national norming sample for the CAT.

In contrast, to have a 90 percent chance of passing the Maryland Functional Reading Test, the student must score in at least the fourth stanine of the reading portions of the California Achievement Test. Since to achieve at this level students must only surpass the scores of 23 percent of the students in the national norming sample, this cut score seems much more in keeping with standards established for functional measures.

Results for Special Education Students

Given that passing the MFMT is a requirement for special education students at Levels 1, 2, and 3 starting next year with the Class of 1987, and for students at Levels 4 and 5 starting two years from now with the Class of 1989, it was important to see how special education students fared on the MFMT. As shown in Exhibit 5, passing rates were very low for special education students, with students at Levels 3, 4, and 5 having passing rates of 11, 3, and 10 percent, respectively.

Analyses of Results by Race and Ethnic Group

Exhibits 1, 2, and 4 indicate marked differences in passing rates for students of different races. Whereas black and Hispanic students passed the ninth grade test at rates of 34 and 42 percent respectively, whites and Asians passed at rates of 70 and 77 percent.

The data in Exhibit 4 are especially puzzling. Note that of the students who had scored in the fifth stanine on the CAT, the results for the MFMT were that 50 percent of the Asians, 32 percent of the Hispanics, 28 percent of the whites, and 16 percent of the blacks passed. Given that the actual mean scores for these groups were within one NCE point of one another, this suggests that this test is of differential difficulty for students who scored at about the same level on the CAT. Given that the mode for black students falls within the fifth stanine on the CAT, this finding is of particular import.

Also note that this disparity does not occur at the fifth stanine of CAT for the MFRT, where 97 percent of the whites and 98 percent of the blacks pass the reading test, but this may be due to the low passing score required on the MFRT.

Does this mean that the Maryland Functional Math Test is biased? We don't know. But it is clear from these results that more work is needed in this area before citizens can be assured that the test is not biased, since these data indicate that at the level at which the most black students are located, a disparate impact has occurred. It will be especially important to determine the reasons for this disparity and whether it is a local or statewide phenomenon.

Exhibit 4

Number and Percentage* of Students in Each CAT Stanine Who Pass the MFMT and MFRT in Grade 9 by Race

MATH

CAT Math Total Stanine	Percentile Range	Number Tested (N) and Percentage Passing (%)									
		Asian		Black		Hispanic		White		Total	
		N	%	N	%	N	%	N	%	N	%
1	1-4	**		10	0	**		**		20	0
2	5-10	**		28	0	**		29	0	58	0
3	11-22	**		46	4	11	9	85	2	146	4
4	23-40	11	9	154	5	29	14	344	9	551	8
5	41-59	30	50	185	16	44	32	718	28	979	27
6	60-77	56	59	138	51	50	56	1058	65	1304	63
7	78-89	73	96	105	84	33	91	1216	91	1432	91
8	90-95	69	99	29	97	20	90	709	98	829	98
9	96-99	111	100	35	100	20	100	927	99.7	1096	99.7
Total Number Tested		353		740		209		5095		6415	

READING

CAT Reading Total Stanine	Percentile Range	Number Tested (N) and Percentage Passing (%)									
		Asian		Black		Hispanic		White		Total	
		N	%	N	%	N	%	N	%	N	%
1	1-4	**		24	58	**		16	69	48	69
2	5-10	**		41	54	**		35	57	88	60
3	11-22	14	100	78	72	**		77	86	180	81
4	23-40	31	97	158	89	38	90	382	92	610	91
5	41-59	47	98	157	98	49	98	703	97	958	98
6	60-77	64	100	133	99	36	100	1023	99	1257	99
7	78-89	67	100	87	100	29	97	1080	99.7	1267	99.7
8	90-95	57	100	48	98	20	100	893	99.9	1024	99.8
9	96-99	63	100	32	100	19	100	916	100	1031	100
Total Number Tested		354		758		209		5125		6463	

*These results are for ninth graders who took both the functional tests in Grade 9 and the CAT in Grade 8.

**No data reported because there are less than 10 students at that level.

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Exhibit 5

Percentage of Special Education Students Passing the MFMT
Fall, 1982

Special Education Level	Number Tested	Percent Passing
1	53	32
2	124	22
3	225	11
4	36	3
5	62	10

Analysis of Results by Math Program

Exhibit 6 shows the percentage of students passing the test, with the students grouped by the math course in which they were enrolled last fall. The results show passing rates which range from over 96 percent in Geometry A and Unified Math 3A to 13 percent for students enrolled in Math 9A. What these data clearly show is that students are already grouped in such a manner as to facilitate remediation, since the bulk of the students failing the test were enrolled in either Math 9A or Algebra I, Part IA.

Analysis of Results by School

Analyzing results by school is important not because we want to "point the finger at certain schools," but rather to determine the extent to which the failures are a relatively limited vs. countywide problem. The data indicate that this is a countywide issue.

Looking at the ninth-grade passing rates by school in Exhibit 7, one finds no school in the county in which at least 90 percent of the students passed the test, and only six schools with a passing rate of 80 percent or better.

Conclusions

The major results of the analysis of the 1982-83 administration of the MFMT are as follows:

1. Both the seventh and ninth grade versions of the MFMT appear to be thoughtfully constructed tests with a high degree of face validity.

Exhibit 6

Number and Percentage of Students in Various Courses Passing the MFMT
Fall, 1982, by Race in Grade 9

Course	ASIAN		BLACK		HISPANIC		WHITE		TOTAL	
	# Tested	% Passing	# Tested	% Passing	# Tested	% Passing	# Tested	% Passing	# Tested	% Passing
MATH 9 A	37	24	341	6	111	11	853	16	1348	13
UNIFIED MATH 3 A	31	97		*		*	197	100	241	100
ALGEBRA I Pt. 1A	40	45	200	28	63	38	883	47	1186	43
ALGEBRA I A	182	81	241	61	103	63	2314	82	2847	80
GEOMETRY A	151	95	77	93	40	82	1363	96	1634	96

*No data reported because there are fewer than 10 students.

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Exhibit 7

MCPS School Results on the
Maryland Functional Math Test
October 1982

Grade 9

	Number of Students Tested	Percentage Passing
Banneker	270	75
Bell	289	50
Bethesda-Chevy Chase	387	63
Blair	170	36
Cabin John	272	89
Damascus	264	66
Einstein	255	52
Gaithersburg Junior	296	61
Hoover	269	84
Walter Johnson	222	66
Kennedy	371	55
Key	220	50
King	212	64
Magruder	283	70
Richard Montgomery	293	50
Montgomery Village	287	64
Northwood	247	56
Parkland	214	69
Poolesville	129	48
Ridgeview	270	63
Rockville	196	51
Sherwood	300	58
Takoma Park	180	46
White Oak	325	67
Whitman	423	85
Wood	228	80
Woodward	243	81
Wootton	382	84

2. When viewed in the context of the MFRT and the California Achievement Tests--the other two components of the state accountability triangle--questions must be raised about the passing score for the MFMT. Placed where it now is, at 81 percent vs. 59 percent for the MFRT, an appearance of a crisis in mathematics is created; whereas, in reality, one need only reverse the cut scores for the two tests to immediately bring about a "crisis" in reading.

3. The impact of the present cut score on special education students will be especially significant. At Levels 3 and above, fewer than 10 percent of the students were able to pass the test.

4. While our preliminary examination did not uncover any evidence of racial bias per se, it did identify a strong disparate impact of the test. This is true both when we look at overall passing rates and when we examine the performance on the MFMT of students who appear similar on other measures of mathematics achievement. Specifically, looking at students who scored in the fifth stanine of the CAT on Total Math, 50 percent of the Asians, 32 percent of the Hispanics, 28 percent of the whites, and 16 percent of the blacks passed the MFMT. (This is despite the fact that the mean CAT scores for these students are within one NCE point of one another, and that similar discrepancies do not occur on the MFRT when the analysis is replicated.)

5. Analysis of passing rates by school and by math class indicate that with the present cut score, the problem is countywide in scope and largely confined to students taking Math 9A and Algebra I, Part 1A. Both of those courses are designed for students not ready to enter the regular Algebra I, college-preparatory mathematics course.